NORTHEAST ELECTRONICS

A DIVISION OF NORTHERN TELECOM, INC.

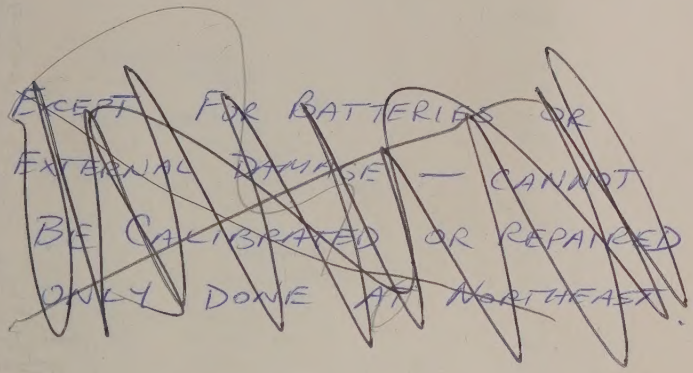
INSTRUCTION MANUAL

MODEL 7005
T1 BRIDGING ERROR DETECTOR

No. A7005-00-600 ISSUE 1 DATE MAR 72

PRINTED IN U.S.A.

Airport Rd., Concord, N.H. 03301 • (603) 224-6511 • TELEX 94-3453



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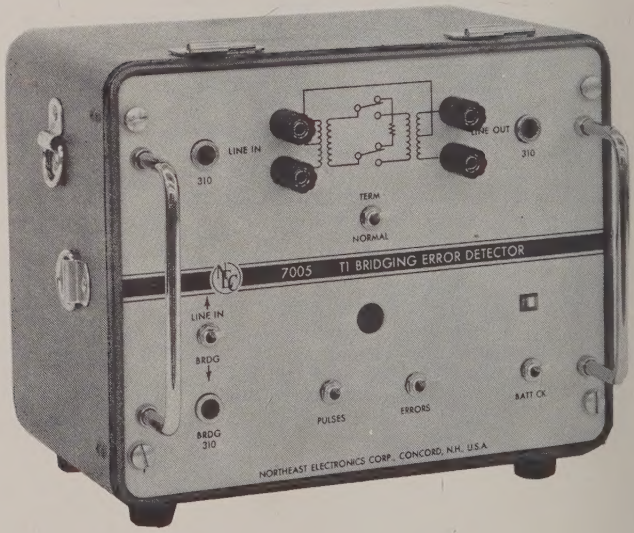


Figure 1-1. Model 7005 T1 Bridging Error Detector

SECTION 1

DESCRIPTION

1.1 GENERAL.

1.2 The Northeast Electronics Corporation Model 7005 is a solid-state, portable, T1 error detector that can be bridged across a carrier repeatered line at any point without disturbing operation. It indicates the presence of pulses or bipolar violations at the input or output of a repeater, at a cable splice, at a main frame, or at any other accessible point inside or outside the central office.

1.3 The Model 7005 internal circuitry includes self-equalizing, self-regulating, self-timing, and regenerating features similar to those found in most self-regulating repeaters. A passive circuit is also provided to facilitate carrying through the simplexed line power and at the same time allowing the line to be terminated to sectionalize a trouble. Power, supplied by nine D cells, is applied only when checking for pulses or errors. Expected battery life is approximately one year. A front panel meter gives a go/no-go indication of battery condition.

SECTION 2

SPECIFICATIONS

2.1 INTRODUCTION.

2.2 Table 2-1 lists the specifications for the Model 7005 T1 Bridging Error Detector.

Table 2-1. Specifications

Range	Line losses from 0 dB to 36 dB at 772 kHz. Self equalizing.
Bridging impedance	Approximately 10,000Ω
Error detector	A flashing letter P on the display indicates the presence of pulses when the PULSES switch is operated. When the ERRORS switch is operated, the presence of individual errors is stretched out to 100 milliseconds and displayed as the letter E.
Temperature range	0° C to +50° C for carbon-zinc batteries. -25° C to +60° C for alkaline manganese batteries. Alkaline manganese batteries are supplied and are recommended for replacement.
Power	9 D cells
Size	7" x 9" x 9 1/8"
Weight	11 pounds

SECTION 3

OPERATING INSTRUCTIONS

3.1 INTRODUCTION.

3.2 Table 3-1 lists the functions of all operating controls, indicators and connectors shown on figure 3-1.

Table 3-1. Operating Controls, Indicators, and Connectors

Control, Indicator or Connector	Ref Desig	Function
LINE IN 310 jack	J2	Receptacle for type 310 telephone plug. Used for connecting incoming line when sectionalizing a trouble.
LINE IN binding posts	J4 & J5	Connected in parallel with J2.
LINE OUT 310 jack	J3	Receptacle for type 310 telephone plug. Used for connecting outgoing line when sectionalizing a trouble.
LINE OUT binding posts	J6 & J7	Connected in parallel with J3.
TERM/NORM switch	S4	When set to NORM, LINE IN connectors are transformer coupled to LINE OUT connectors. When set to TERM, input signal is terminated without interupting simplex power loop.
LINE IN/BRDG switch	S5	In LINE IN position, internal circuits are bridged across J2 or J4-J5. In BRDG position, circuits are bridged across J1.
BRDG 310 jack	J1	Connector for type 310 telephone plug that is bridged directly across line.

Table 3-1 (cont)

Control, Indicator or Connector	Ref Desig	Function
Pulses/Errors indicator	DS1	A letter P is displayed when PULSES switch S1 is operated and pulses are present on the line. The letter E is displayed when ERRORS switch S2 is operated and bipolar violations are present on the line.
PULSES switch	S1	When operated, pulses are detected and the letter P is displayed.
ERRORS switch	S2	When operated, bipolar violations are detected and the letter E is displayed.
BATT CK switch	S3	When operated, condition of battery is observed on M1.
Battery meter	M1	Battery condition is satisfactory when meter indicates in white sector as BATT CK switch is operated. Unsatisfactory condition is indicated by red sector.

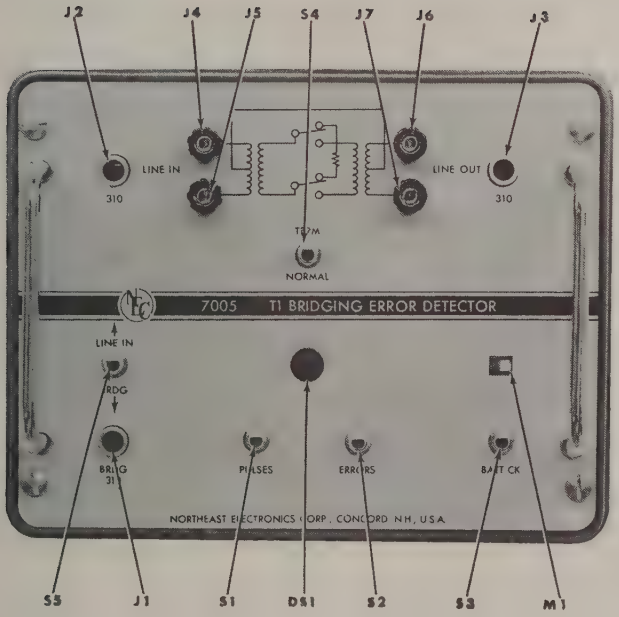


Figure 3-1. Model 7005, Operating Controls

3.3 OPERATION.

3.4 Operation of the Model 7005 consists of a direct bridging mode for measurements that can be made without interrupting service and a sectionalizing mode that requires temporary service interruption to connect the instrument.

NOTE

The input circuit of the Model 7005 is high impedance and self-regulating and as such, the pulse and error indications are not affected by the length of the connecting cord. A normal T1 line, however, may be seriously affected by bridging even a few hundred picofarads of capacitance across it. In order to minimize this effect, the patch cord length should never exceed 12 ft. total (two 6 ft. cords for sectionalizing or one 12 ft. cord for bridging). These lengths, however, may be doubled by using 22ga., twisted pair (frame wire) or "zip" cord. Shorter lengths, where feasible, allow more margin against degradation.

3.5 BRIDGING MODE.

3.6 In this mode of operation, the high-impedance measuring circuits are bridged directly across the line under test. To operate in the bridging mode, perform the following steps.

1. Operate BATT CK switch. Meter must indicate in white sector. If it does not, replace batteries as instructed in Section 5.

2. Insert 310-to-clip lead cord into BRDG 310 jack.
3. Place clip leads across line under test.
4. Set LINE IN/BRDG switch to BRDG.

NOTE

Pulses and errors can be checked at any point on digital line.

5. Operate PULSES switch. If pulses are present on line, the letter P will flash in display window.

6. Operate ERRORS switch. If any bipolar violations are present, the letter E will flash in display window.

3.7 SECTIONALIZING MODE.

3.8 In this mode, the line must be interrupted momentarily and the sectionalizing circuit inserted in series with the line. To sectionalize a trouble, perform the following steps.

1. Operate BATT·CK switch. Meter must indicate in white sector. If it does not, replace batteries as instructed in Section 5.

2. Break line connections.

3. Connect incoming line pair to LINE IN 310 jack or to binding posts.

4. Connect outgoing line pair to LINE OUT 310 jack or to binding posts.

5. Set LINE IN/BRDG switch to LINE IN.

6. Set TERM/NORMAL switch to NORMAL.

7. Operate PULSES switch in down position. If pulses are present on line, the letter P will flash in display window.

8. Operate ERRORS switch in down position. If pulses are present on line, the letter E will flash in display window.

9. If errors are present, set TERM/NORMAL switch to TERM.

10. Repeat steps 7 and 8. If errors are present, they are on incoming line. If line is now error free, the outgoing line probably has a discontinuity in it.

SECTION 4

CIRCUIT DESCRIPTION

4.1 INTRODUCTION.

4.2 Paragraphs 4.3 through 4.15 provide a block diagram level description and paragraphs 4.16 through 4.25 provide the detailed circuit descriptions.

4.3 BLOCK DIAGRAM DESCRIPTION.

4.4 The Model 7005 (figure 4-1) consists of an input switching and terminating section located on PC2, an automatic line-build-out preamplifier section on PC1, and an error detector section also located on PC2.

4.5 INPUT SECTION.

4.6 When S5 is set to the BRDG position, BRDG 310 jack J1 can be bridged across the carrier line at any point without disturbing service. This is a result of the high-impedance primary circuit of input transformer T1 located on PC1. To sectionalize a trouble, S5 is set to LINE IN, the carrier line is opened, and one end is connected to either J2 or J4-J5 and the other end to either J3 or J6-J7. With S4 set to NORMAL, line operation is restored and the simplex line power is carried through coupling transformer T1. As in the bridging mode, input transformer T1 on PC1 is bridged across the line. When S4 is set to TERM, the incoming line is terminated in 100 Ω and only the incoming line is tested.

4.7 ALBO PREAMPLIFIER SECTION.

4.8 The ALBO preamplifier circuit board performs two basic functions : (1) It provides automatic line-build-out to compensate for different signal levels and frequency responses encountered at various points in the T-carrier system and (2) It regenerates digital pulses for use by the pulse and error detectors located on PC2.

4.9 The digital signal at the output of T1 is applied to preamplifier U2 and part of U1. Impedances Z1 and Z2 provide fixed equalization for the maximum cable length in addition to high-frequency gain roll-off. The balanced preamplifier output is applied to full-wave peak detector Q1 and Q2 to generate positive pulses that are

applied to the clock recovery circuit and to AGC amplifier Q3 and part of U1. The AGC amplifier generates an output current that is proportional to the peak amplitude of the preamplifier output. This current varies the small-signal resistance of diodes CR1 through CR4. The network consisting of R1, R2, C3, and the small-signal diode resistance functions to provide a variable low-frequency flat gain and a variable break-point frequency that automatically matches the cable characteristcs from zero to 6000 feet of 22 guage pulp cable pair or equivalent.

4.10 A second output of the peak detector is applied to clock recovery circuit Q6 and Q7 that recovers the 1.544 MHz component of the incoming signal. Spike generator U4 and Q8 through Q10 generates a sharp spike during the expected signal time slot for use as the sampling input to the gates and threshold detector. If the input to the threshold detector exceeds a predetermined level when the clock pulse is present, the output is a regenerated pulse. The regenerated pulses are supplied in a positive, unipolar, double-rail format.

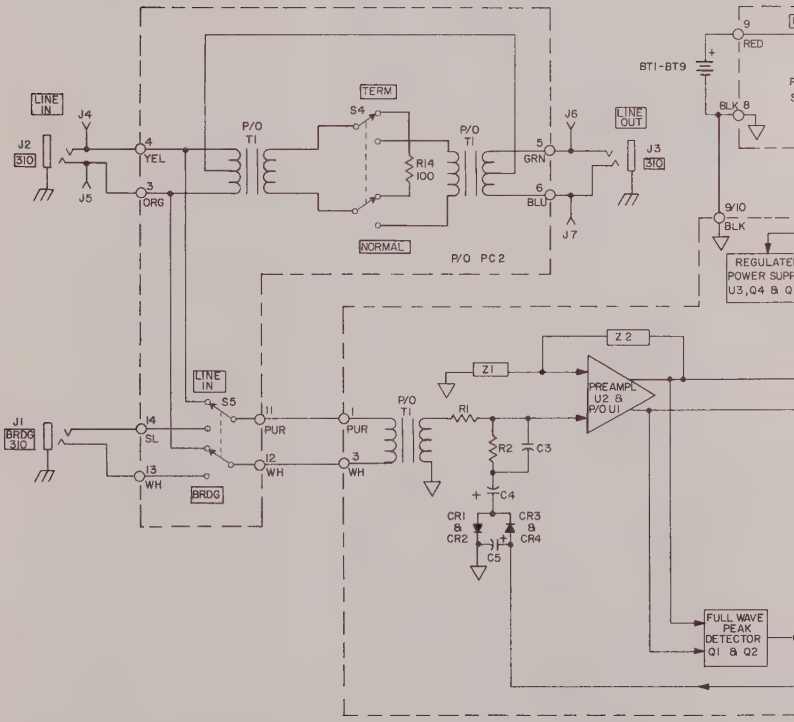
4.11 Also located on PC1 is a series regulated power supply that furnishes +6.5 volt and +5 volt outputs when either S1, S2, or S3 is held in the down position.

4.12 ERROR DETECTOR SECTION.

4.13 The error detector section consists of error and pulse detectors, a display group, and battery check circuits.

4.14 The pulse detector generates an output pulse for each signal pulse present and the error detector generates one pulse for each bipolar violation. To check for the presence of pulses, S1 is operated and the detected pulses are routed to the display timer and driver that causes DS1 to display a flashing P. When S2 is operated to check for errors, bipolar violations cause a flashing E to be displayed. If both S1 and S2 are operated simultaneously, the pulse function overrides the error function.

4.15 Whenever S3 is operated, battery BT1-BT9 is connected to M1 through the battery check circuit. An indication in the white sector of the meter indicates that the battery is in satisfactory condition.


LINE IN
J4
J2
310
J5
4
YEL
3
ORG
P/O T1
TERM
S4
R14 100
NORMAL
P/O PC2
P/O T1
J6
5
GRN
6
BLU
J7
LINE OUT
J3
310
BT1-BT9
9
RED
BLK 8
9/10
BLK
REGULATE
POWER SUPP
U3,Q4 & Q
Z2
Z1
PREAMPL
U2 & P/O U1
LINE IN
S5
J1
BRDG
310
14
SL
13
WH
BRDG
11
PUR
12
WH
1
PUR
3
WH
P/O T1
R1
R2
C3
C4
CR1 & CR2
CR3 & CR4
C5
FULL WAVE PEAK DETECTOR
Q1 & Q2

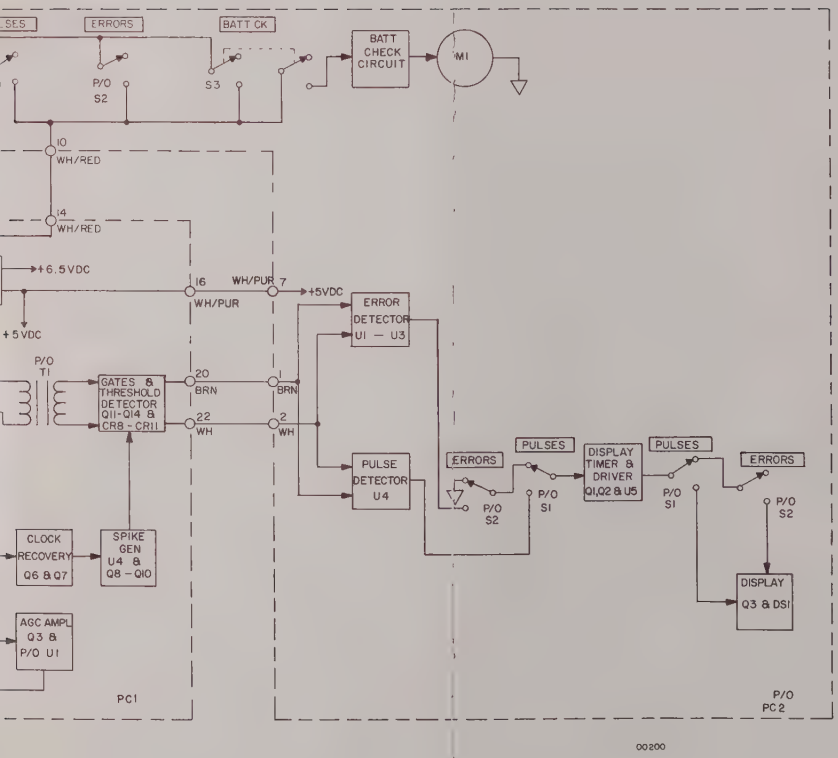
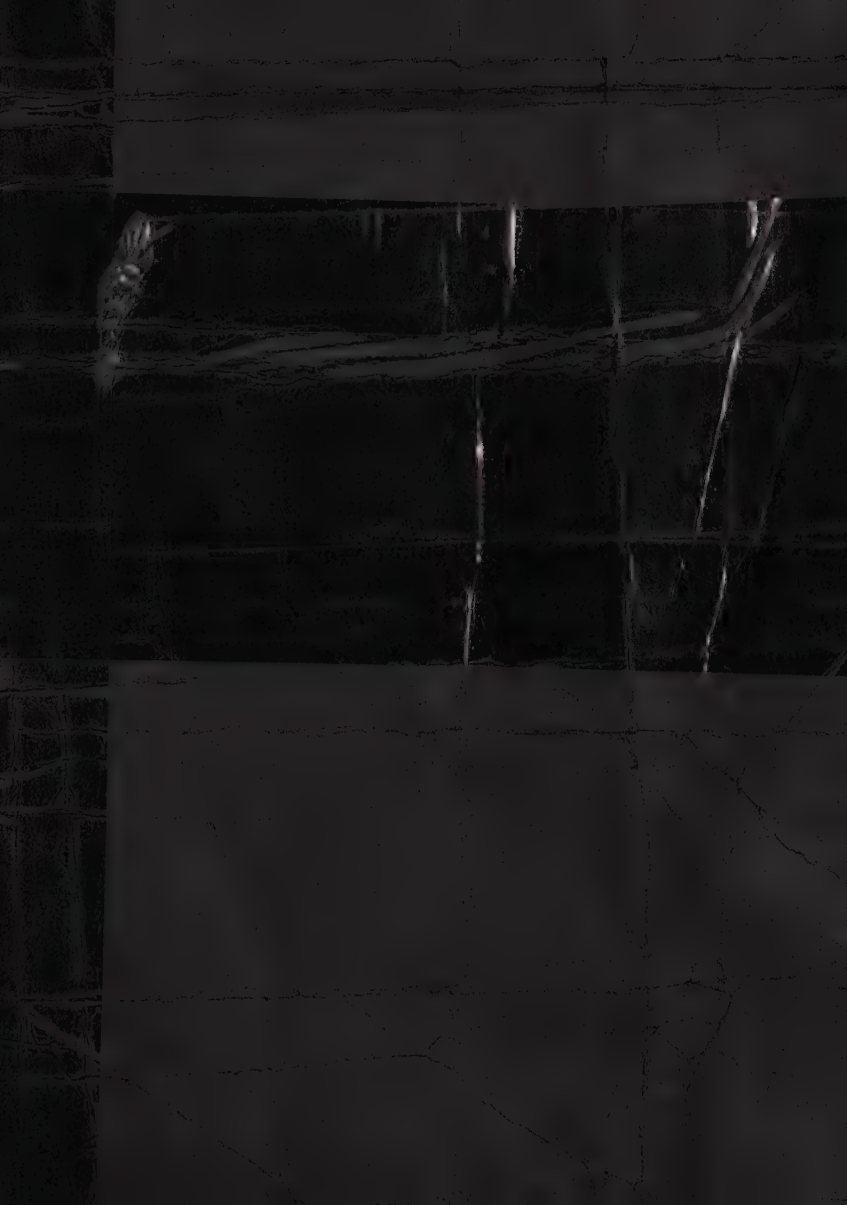


Figure 4-1. Model 7005 Functional Block Diagram



4.16 DETAILED CIRCUIT DESCRIPTION.

4.17 Paragraphs 4.18 through 4.22 provide detailed circuit descriptions of ALBO preamplifier circuit board PC1 and paragraphs 4.23 through 4.25 provide the description for error detector circuit board PC2.

4.18 ALBO PREAMPLIFIER PC1.

4.19 Refer to figure 7-2 for the schematic diagram and figure 4-2 for the timing diagram, The balanced signal input to the board is converted to a single-ended circuit by transformer T1. Operational amplifiers U2 and U1A; in conjunction with R8, R9, C9, L1, and R10; form a feedback amplifier that provides fixed equalization for the maximum cable length of 6000 feet. The low-frequency gain of approximately 10 dB is established by R8 and R9. At approximately 80 kHz, due to R9 and C9, the gain starts to rise at 6 dB per octave to track the cable loss characteristic. The rising gain is checked at 800 kHz due to R10 and L1 and peaks at approximately 30 dB at 1 MHz. Above 1.5 MHz the gain rolls off at 12 dB per octave due to L1 and C8. The balanced output from U1A is applied to T1 for use by the gates and threshold detectors and to full-wave peak detector Q1 and Q2. These stages conduct alternately to produce a series of positive half sine waves. The emitter follower configuration provides the required buffering. This signal is used to drive the clock recovery circuits and AGC amplifier U1B. The AGC amplifier output is a series of negative pulses that is applied to the base of variable current source Q3. This stage provides a proportional dc current with filtering provided by C5. The current varies the small-signal resistance of diodes CR1 through CR4 which in turn control the flat-loss gain and break-point frequency of the entire ALBO preamplifier. As the instrument is connected to longer lines, the ALBO preamplifier flat gain increases and the break-point frequency becomes lower. AGC adjustment R22 is used to calibrate the control loop.

4.20 The clock circuitry consists of Q6 through Q10 and U4A and U4B that recovers the clock frequency and produces a pulse in the correct time slot with respect to the received data. Emitter follower Q6 provides buffering and couples the positive full-wave rectified sine waves to tuned amplifier Q7. Inductor L2 and capacitors C20A and C20B form a tuned circuit resonant at the basic signal rate of 1.544 MHz. The tuned circuit has a relatively high Q

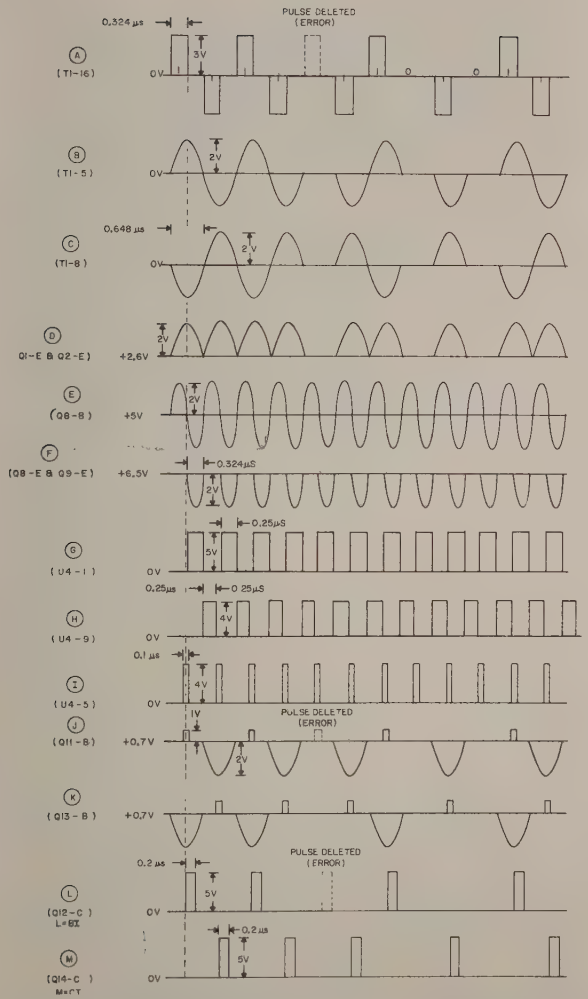


Figure 4-2. ALBO Preamplifier Circuit Board, Timing Diagram

to allow the amplifier to sustain oscillation between pulses in the received signal. Differential amplifier Q8 and Q9 and inverter Q10 have a high gain and produce sharp, positive pulses at U4A-1. These pulses are delayed and further sharpened by U4A and U4B to produce narrow positive spikes at U4B-5 that are located in the center of the expected signal time slots. These pulses, along with the equalized signal pulses are applied to the gates and threshold detectors.

4.21 The balanced sine-wave output at pins 5 and 8 of T1 are applied to diodes CR9 and CR11 and the clock pulses to diodes CR8 and CR10. These diodes and resistors R38 and R42 form AND gates. As an example of the operation, assume that the signals at CR9 and CR8 are simultaneously positive. If the digital signal at CR9 is equal equal to or greater than 1 volt peak (50 percent of the expected signal level) Q11 conducts and generates a negative pulse. This pulse, in turn, cuts Q12 off and produces a positive pulse at the collector of Q12. Thus every bipolar signal pulse results in a positive pulse at the collector of either Q12 or Q14. These pulses are applied to the pulse and error detectors on PC2.

4.22 Integrated circuit U3 and transistors Q4 and Q5 form a conventional series regulated power supply. Zener diode CR5 is the reference voltage source and resistors R26, and R27, and R28 provide a sample of the output voltage. Any difference between the reference and sample voltages is amplified by U3 and Q5 and used to control the conduction of series pass transistor Q4. Two diode drops supplied by CR6 and CR7 result in a second output of approximately +5 volts.

4.23 ERROR DETECTOR PC2.

4.24 Refer to figure 7-3 for the schematic diagram and figure 4-3 for the timing diagram. The unipolar signal inputs are applied to both the error and pulse detectors in parallel. For each signal bit, pulse detector U4A and U4B produces a positive pulse that is applied to part of S1 and is also the clock pulse for JK flip-flop U1. This stage, along with NAND gates U2A and U2B and exclusive OR gate U3A, B, C, and D forms the error detector. The flip-flop simply toggles along with the signal input, changing state each time U4A-1 goes negative. During normal, error-free operation, the Q and $\overline{Q}$ outputs of U1 alternately go high at the end of every signal pulse. Thus during the time a signal pulse is present, the

respective Q and $\overline{Q}$ input to NAND gates U2A and U2B is low and the NAND gate outputs are both high. A characteristic of an exclusive OR gate is that it prevents a high output when both inputs are high. This results in a low level at U3C-8 during normal operation. During bipolar violations, however, pulses are added or deleted and result in adjacent pulses on either the J or K inputs to U1. For example, assume that the error occurs in two adjacent time slots on the J input of U1. The normal first pulse sets Q high and the second or error pulse has no effect on the flip-flop. Thus during the error pulse both inputs to U2B are high and its output goes low. This causes the exclusive OR to generate a positive pulse for each error at U3C-8.

4.25 When PULSES switch S1 is held in the down position, the first pulse from U4A-1 triggers display one-shot multivibrator U5A. The Q output at U5A-13 goes high for 50 milliseconds and turns on drivers Q1 and Q2 to ground resistors R6 through T10. This causes the segments that make up the letter of the LED display to be displayed for 50 milliseconds. The output at U5A-13 also triggers another one-shot multivibrator U5B to prevent U5A from being triggered for 100 milliseconds (50 milliseconds after the display ends). Therefore in the presence of continuous pulses or errors the display duty cycle is limited to 50 percent. Transistor Q3 provides the current for the display.

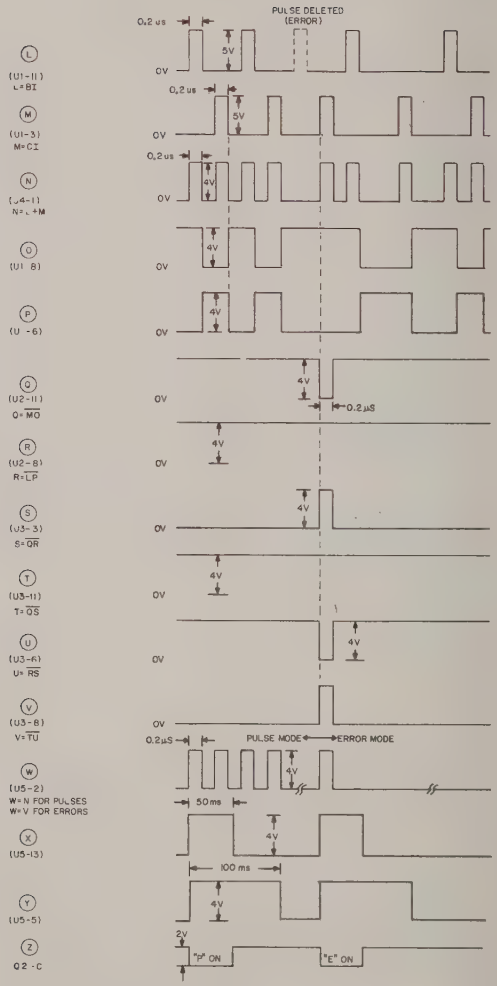


Figure 4-3. Error Detector Circuit Board, Timing Diagram

SECTION 5

MAINTENANCE AND CALIBRATION

5.1 INTRODUCTION.

5.2 This section contains a battery replacement procedure, a calibration procedure, and troubleshooting aids.

5.3 BATTERY REPLACEMENT.

5.4 To replace the nine D cell batteries, perform the following steps.

1. Loosen the four captive screws mounted in the corners of the front panel.

2. Remove the four screws that secure rear battery cover.

3. Replace the nine batteries with Alkaline-Manganese cells to obtain maximum performance. Observe correct polarities.

4. Replace cover and screws.

5. Return chassis to case and tighten the captive screws.

5.5 CALIBRATION.

5.6 The following calibration porcedure is intended primarily for use after corrective maintenance. However, it can be used as a periodic check by simply omitting the actual adjustments if they are not required. To calibrate the Model 7005, perform the following steps. Refer to figures 7-1, 7-2, and 7-3 for the schematic diagrams.

1. Remove chassis from case.

2. Remove battery cover.

3. Remove all batteries.

4. Connect variable power supply across battery terminals. Observe correct polarity.

5. Adjust power supply output to 8.5 volts.

6. Hold BATT CK switch in down position and on error detector board adjust R12 to obtain mid scale indication on front panel meter.

7. Disconnect variable power supply.

8. Reinstall batteries and battery cover.

NOTE

All voltages and waveforms in the following steps are taken with respect to battery common.

9. Connect voltmeter to pin 14, (red-wht) on preamp board.

10. Set BATT CK switch to down position. Voltmeter should indicate 13.5 volts and front panel meter should indicate in the white sector.

11. Connect voltmeter to jumper terminals A on preamp board.

12. On preamp board, adjust R27 to obtain an indication of 6.5 volts on voltmeter.

13. Connect random signal generator to BRDG jack.

14. Adjust signal generator output level to 6.0±0.6 volts peak-to-peak.

15. Set LINE IN/BRDG switch to BRDG.

16. Connect high-frequency oscilloscope to jumper terminals B on preamp board.

17. Hold PULSES switch in down position and on preamp board, adjust R22 to obtain a 4 volt peak-to-peak signal on oscilloscope.

18. Connect oscilloscope to jumper terminals C. Signal amplitude should be 4 volts peak-to-peak.

19. On the preamp board, connect oscilloscope to junction of R33

and emitters of Q8-Q9.

NOTE

Use non-metallic tuning wand to adjust L2.

20. Hold PULSES switch in down position and on preamp board, adjust L2 to obtain a maximum amplitude signal on the oscillosope.

21. Remove all test equipment and install chassis in case.

5.7 TROUBLESHOOTING AIDS.

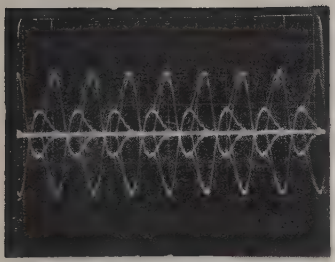
5.8 As aids to troubleshooting key waveforms are shown in figure 5-1 and key transistor terminal voltages are listed in table 5-1. The conditions under which the waveforms and voltages were taken are also listed.

Table 5-1. ALBO Preamplifier Circuit Board Operating Voltages

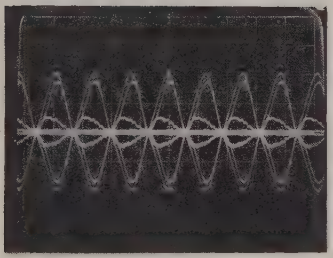
Test Point	Voltages
R11-R12 JCT	2.5
U2-8	1.9
U2-5	1.9
U2-6	2.2
U2-7	2.2
R5-R6 JCT	2.7
R15-R16 JCT	3.25
Q1-Q2E	2.7
U1B-11	4.3
U1B-12	BATT
Q3-C	0.0
Q6-E	2.0
Q7-E	1.3
Q8-89-E	5.5
Q9-C	0.6
U4B-5	0.1
Q11-B	0.6
Q11-C	6.5
Q12-B	0.6
Q12-C	0.1
Q13-B	0.6
Q13-C	6.5
Q14-B	0.6
Q14-C	0.1
R46-R47 JCT	1.0

NOTE

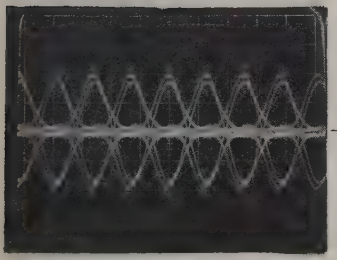
Voltages taken with no signal input and either S1, S2, or S3 held in down position.



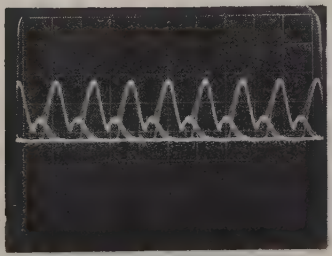
T1
PINS 5 TO 8
0 FT.
CABLE



T1
PINS 5 TO 8
3000 FT.
CABLE



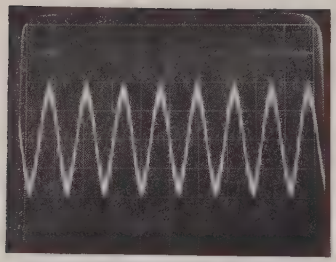
T1
PINS 5 TO 8
6000 FT
CABLE

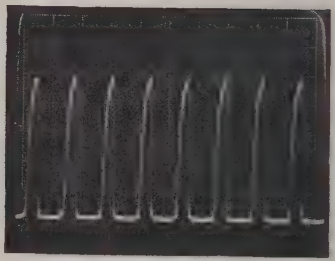


Q1-E AND Q2-E

Note: Unless otherwise indicated, waveforms taken with 1.544 MHz pseudo-random input of 6 VPP at zero feet of cable. If cable is specified it is 22 guage cable pair. Oscillscope settings are V= 1V/DIV and H=0.5μs/DIV.

Figure 5-1a. ALBO Preamplifier Circuit Board Waveforms





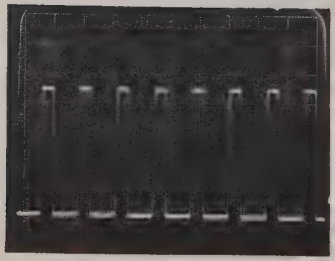
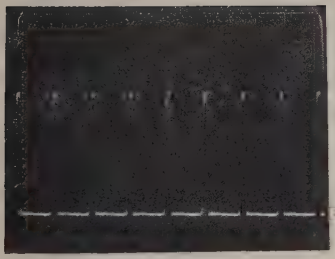
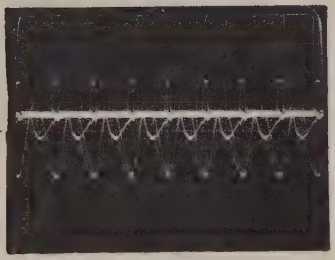


Figure 5-1b. ALBO Preamplifier Circuit Board Waveforms



U4B-5



Q11-B OR
Q13-B

Q12-C OR
Q14-C

Figure 5-1c. ALBO Preamplifier Circuit Board Waveforms

SECTION 6

ELECTRONIC PARTS LIST

6.1 INTRODUCTION.

6.2 The following pages contain the electronic parts list for the Model 7005 T1 Bridging Error Detector.

6.3 LIST OF MANUFACTURERS.

Table 6-1. LIST OF MANUFACTURERS

P/L Name	Manufacturer
AB	Allen & Bradley, Milwaukee, Wis. 53204
C&K Comp	C&K Components Inc., Newton, Mass. 02158
Centralab	Centralab, Milwaukee, Wis. 53201
Dickson	Dickson Electronics Corp., Scottsdale, Ariz. 85252
Electra	Electra/Midlands, Mineral Wells, Texas 76067
Electro	Electro Motive Mfg., Willimantic, Conn. 06226
Elmenco	El-Menco Capacitors Products Co., Willimantic, Conn.
Emico	Electro-Mechanical Inst, Co., Perkasie, Pa. 18944
Grayhill	Grayhill Inc., La Grange, Ill. 60525
Helipot	Helipot, Div., Beckman Ins., Fullerton, Calif. 92634
Kemet	Kemet, Div., Union Carbide Corp., Cleveland, Ohio
Litronix	Litronix, Inc., Cupertino, Calif. 95014
Motrola	Motorola Inc., Arcade, N.J. 14009
Nat. Semi	National Semi-Conductor Corp., Santa Clara, Calif.
Nytronics	Nytronics, Berkeley Heights, N.J. 07922
RCA	RCA Corp., New York, N.Y. 10020
RFL	RFL Ind., Boonton, N.J. 07005
Sprague	Sprague Electric Co., Concord, N.H. 03301
Swcrft	Switchcraft Inc., Chicago, Ill. 60630
TI	Texas Instrument Inc., Dallas, Texas 75231
Trnstron	Transitron Electronics Corp., Boston, Mass. 02128

NORTHEAST ELECTRONICS

Table 6-2. Model 7005 Overall Parts List

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLT	MFGR.	MFGR. PART NO.	N.E.C. #
BT1			00	1.5V	EVEREADY	E-95	910200100
BT2	SAME AS BT1						
BT3	SAME AS BT1						
BT4	SAME AS BT1						
BT5	SAME AS BT1						
BT6	SAME AS BT1						
BT7	SAME AS BT1						
BT8	SAME AS BT1						
BT9	SAME AS BT1						
J1			00		SWCRFT	MT-3328	650400300
J2	SAME AS J1						
J3	SAME AS J1						
J4			00		GRAYHILL	29-1R	652400400
J5			00		GRAYHILL	29-1B	652400300
J6	SAME AS J4						
J7	SAME AS J5						
M1		5			EMICO	802PJR	901500100
PC1							C700500011
PC2		PC2			NEC		A700500010

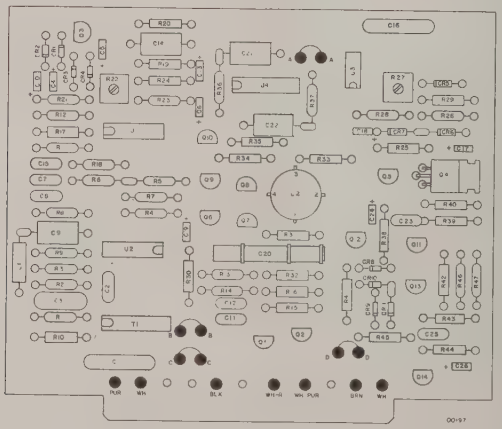


Figure 6-1. ALBO Preamplifier Circuit Board
PC1 (95990) Component Location

NORTHEAST ELECTRONICS

Table 6-3. ALBO Preamplifier Parts List

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLT	MFGR.	MFGR. PART NO.	N.E.C. #
C1	.1MF		20%	500V	SPRAGUE	5GA-P10	330401040
C2	.01MF		20%	50V	CENTRALAB	CK-103	330701030
C3	330UPF		2%	500V	ELMENCO	CD19F332G500	335403320
C4	4.7MF		10%	25V	KEMET	T330A475K025AS	310004751
C5	SAME AS C4						
C6	15MF		10%	10V	KEMET	T330A156K010AS	310001560
C7	SAME AS C2						
C8	1.5PF		5%	1KV	SPRAGUE	10TCC-V15	330301590
C9	220PF		5%	500V	ELMENCO	CM15-E221J	335002210
C10	22MF		10%	6V	KEMET	T330A226K006AS	310002260
C11	SAME AS C2						
C12	SAME AS C2						
C13	8.2MF		10%	15V	KEMET	T330A825K015AS	310008250
C14	100PF		5%	500V	ELMENCO	CM15-E101J	335001010
C15	SAME AS C2						
C16	SAME AS C1						
C17	SAME AS C6						
C18	SAME AS C10						
C19	SAME AS C6						
C20	140/70PF		5%	300V	RFL	HA26509	335500100
C21	68PF		5%	500V	ELMENCO	CM15-E680J	335006800
C22	15PF		5%	500V	ELMENCO	CM15-E150J	335001500
C23	SAME AS C2						
C24	SAME AS C6						
C25	SAME AS C2						
C26	SAME AS C10						
CR1	DO35	500MW	00	20V	TRNSTRON	1N4148	560041480
CR2	SAME AS CR1						
CR3	SAME AS CR1						
CR4	SAME AS CR1						
CR5		500MW	5%	4.7V	MOTOROLA	1N52308	562052300
CR6		3		400V	TRNSTRON	IN4004	560040040
CR7	SAME AS CR6						
CR8	SAME AS CR1						
CR9	SAME AS CR1						
CR10	SAME AS CR1						
CR11	SAME AS CR1						
L1	47UH		5%		NYTRONICS	WEE-47	461001200
L2	52UH				RFL	HD23125	455100800
Q1	TO92AFA	310MW	00	25V	MOTOROLA	MPS6515	550065150
Q2	SAME AS Q1						
Q3	TO92AFA	310MW	00	25V	MOTOROLA	MPS6519	552065190
Q4	TO4PHS	30 W	00	40V	TI	TIP30	552000300
Q5	SAME AS Q1						
Q6	SAME AS Q1						
Q7	SAME AS Q1						
Q8	SAME AS Q3						
Q9	SAME AS Q3						
Q10	SAME AS Q1						
Q11	SAME AS Q1						

Table 6-3. ALBO Preamplifier Parts List (cont)

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLT	MFGR.	MFGR. PART NO.	N.E.C. #
Q12	SAME AS Q1						
Q13	SAME AS Q1						
Q14	SAME AS Q1						
R1	5110-	1/8W	1%		ELECTRA	MF5C	220251111
R2	511-	1/8W	1%		ELECTRA	MF5C	220251101
R3	10K	1/8W	1%		ELECTRA	MF5C	220210021
R4	2870-	1/8W	1%		ELECTRA	MF5C	220228711
R5	1780-	1/8W	1%		ELECTRA	MF5C	220217811
R6	464-	1/8W	1%		ELECTRA	MF5C	220246401
R7	SAME AS R6						
R8	42.2K	1/8W	1%		ELECTRA	MF5C	220242221
R9	SAME AS R3						
R10	470-	1/2W	5%		AB	TYPE EB	200204715
R11	825-	1/8W	1%		ELECTRA	MF5C	220282501
R12	SAME AS R2						
R13	3160-	1/8W	1%		ELECTRA	MF5C	220231611
R14	SAME AS R13						
R15	10K	1/2W	10%		AB	TYPE EB	200201036
R16	SAME AS R15						
R17	SAME AS R15						
R18	1470-	1/8W	1%		ELECTRA	MF5C	220214711
R19	1.5K	1/2W	10%		AB	TYPE EB	200201526
R20	100-	1/2W	10%		AB	TYPE EB	200201016
R21	SAME AS R3						
R22	10K	1/2W	10%		HELIPOT	72PM10K	232701030
R23	28.7K	1/8W	1%		ELECTRA	MF5C	220228721
R24	5.6K	1/2W	10%		AB	EB	200205626
R25	SAME AS R20						
R26	SAME AS R5						
R27	1K	1/2W	10%		HELIPOT	72PM1K	232701022
R28	5.62K	1/8W	1%		ELECTRA	MF5C	220256211
R29	220-	1/2W	10%		AB	TYPE EB	200202216
R30	1K	1/2W	10%		AB	TYPE EB	200201026
R31	SAME AS R30						
R32	SAME AS R29						
R33	SAME AS R30						
R34	SAME AS R19						
R35	2.2K	1/2W	5%		AB	TYPE EB	200202225
R36	SAME AS R28						
R37	SAME AS R28						
R38	SAME AS R15						
R39	SAME AS R35						
R40	56K	1/2W	10%		AB	TYPE EB	200205636
R41	SAME AS R30						
R42	SAME AS R15						
R43	2.2K	1/2W	10%			TYPE EB	200202226
R44	SAME AS R40						
R45	SAME AS R30						
R46	562-	1/8W	1%		ELECTRA	MF5C	220256201
R47	100-	1/8W	1%		ELECTRA	MF5C	220210001
T1							440200100
U1	1401LP				RCA	CA3050	500030500

NORTHEAST ELECTRONICS

Table 6-3. ALBO Preamplifier Parts List (cont)

REFERENCE DESIGNATOR	VALUE	DESCRIPTION POWER	TOL	VOLT	MFGR.	MFGR. PART NO.	N.E.C. #
U2	SAME AS U1						
U3	8PDIL				NAT. SEMI	LM741CN	500007412
U4	14DILP					SN74123N	510074123

NORTHEAST ELECTRONICS

Table 6-4. Error Detector Parts List

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLT	MFGR.	MFGR. PART NO.	N.E.C. #
C1	22MF		10%	6V	KEMET	T330A226K006AS	310002260
C2	10MF		10%	10V	KEMET	T330A106K010AS	310001060
C3	SAME AS C2						
C4	SAME AS C1						
CR1	DO35	500MW	00	20V	TRNSTRON	1N4148	560041480
CR2	SAME AS CR1						
CR3	DO-7	400MW	5%	6.2V	DICKSON	1N709A	562007091
DS1	14P	30MA		3.4V	LITRONIX	DATA-LIT10	728300500
Q1	TO92HSS	310MW	00	40V	MOTOROLA	2N3903	550039030
Q2	TO5HNS	1 W	00	65V	RCA	2N2102	550021020
Q3	SAME AS Q2						
R1	12K	1/2W	10%		AB	TYPE EB	200201236
R2	18K	1/2W	10%		A.B.	18K	200201836
R3	330-	1/2W	10%		AB	TYPE EB	200203316
R4	10K	1/2W	10%		AB	TYPE EB	200201036
R5	390-	1/2W	10%		AB	TYPE EB	200203916
R6	39-	1/2W	5%		AB	TYPE EB	200203905
R7	SAME AS R6						
R8	SAME AS R6						
R9	SAME AS R6						
R10	SAME AS R6						
R11	SAME AS R6						
R12	5K	1/2W	10%		HELIPOT	72XW5K	232705020
R13	2150-	1/8W	1%		ELECTRA	MF5C	220221511
R14	100-	1/8W	1%		ELECTRA	MF5C	220210001
S1	3PDT	5A 2		28V	C+K COMP	7308PHC	620402000
S2	SAME AS S1						
S3	SAME AS S1						
S4	3PDT	5A 2		28V	C+K COMP	7301PHC	620401900
S5	SAME AS S4						
T1	XFMR,DUAL PULSE,16DILP				NEC		A440200100
U1	14DILP		00		TI	SN7472N	510074720
U2	14DILP		00		TI	SN7400N	510074000
U3	SAME AS U2						
U4	14DILP		00	500V	TI	SN7402N	510074020
U5	14DILP					SN74123N	510074123

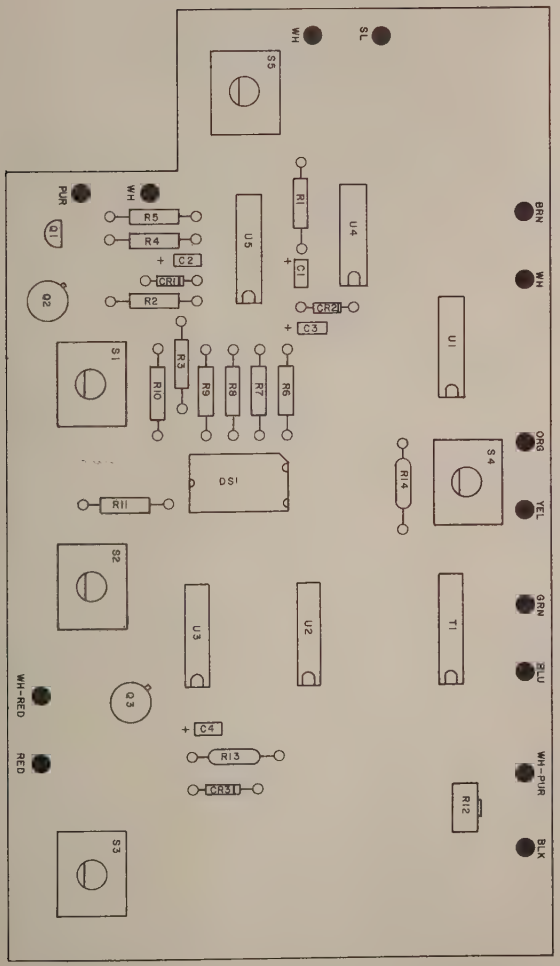


Figure 6-2. Error Detector Circuit Board
PC2 (95955) Component Location

SECTION 7

SCHEMATIC DIAGRAMS

7.1 INTRODUCTION.

7.2 The following pages contain the schematic diagrams for the Model 7005 T1 Bridging Error Detector.

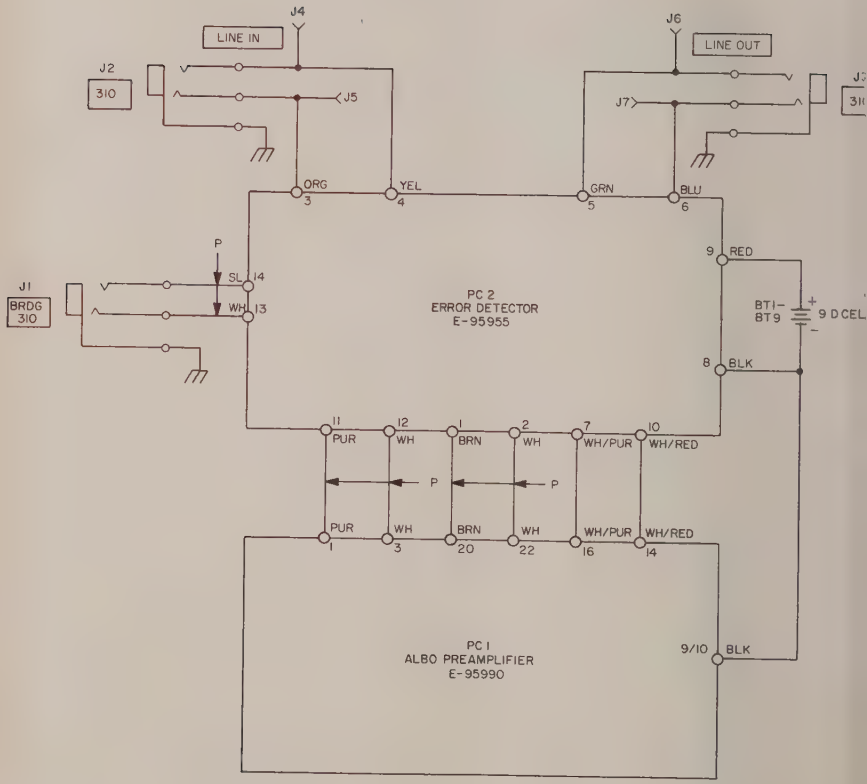
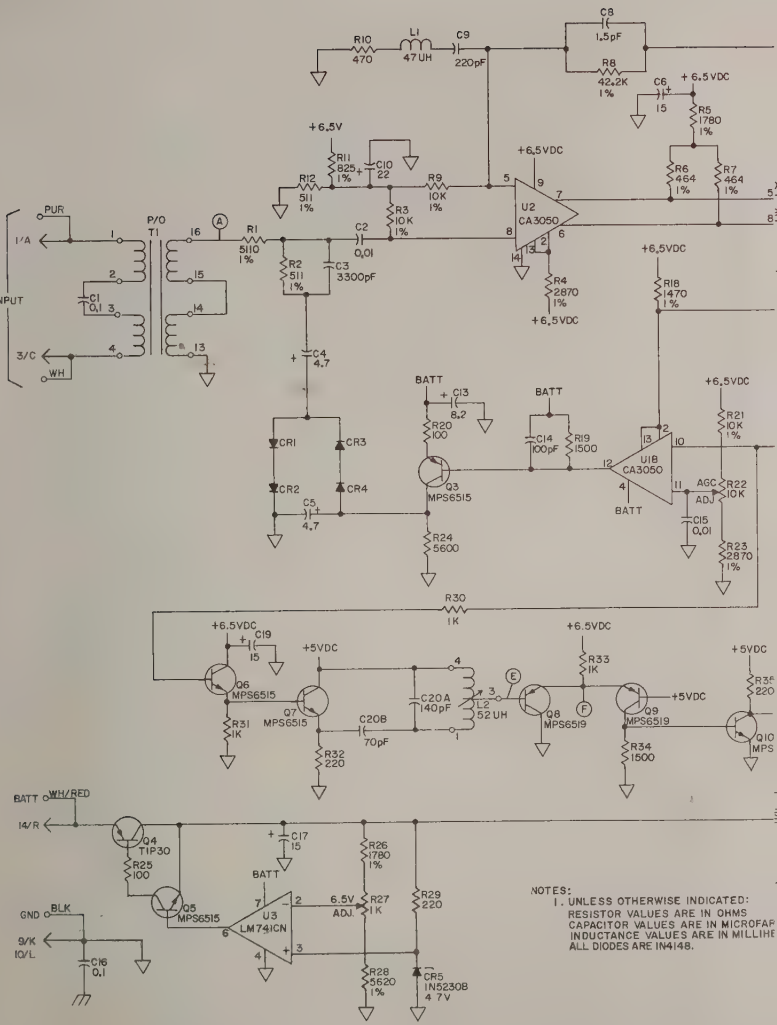
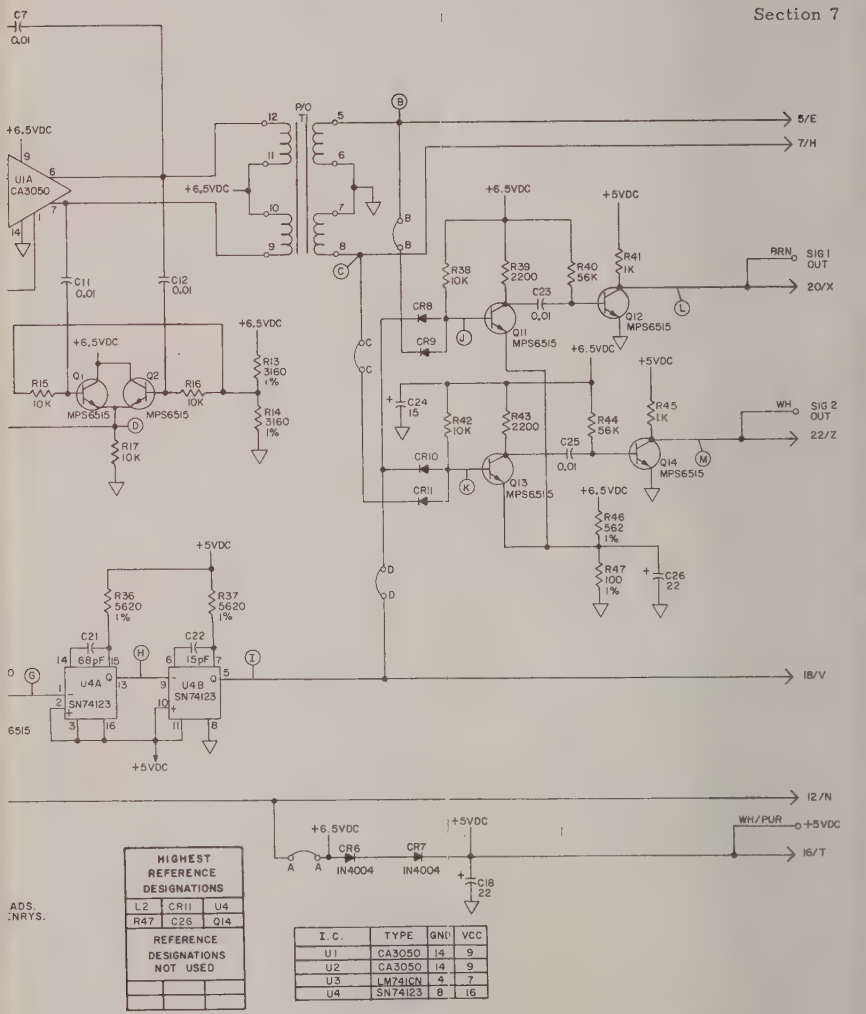


Figure 7-1. Model 7005 Interconnection Diagram



NOTES:

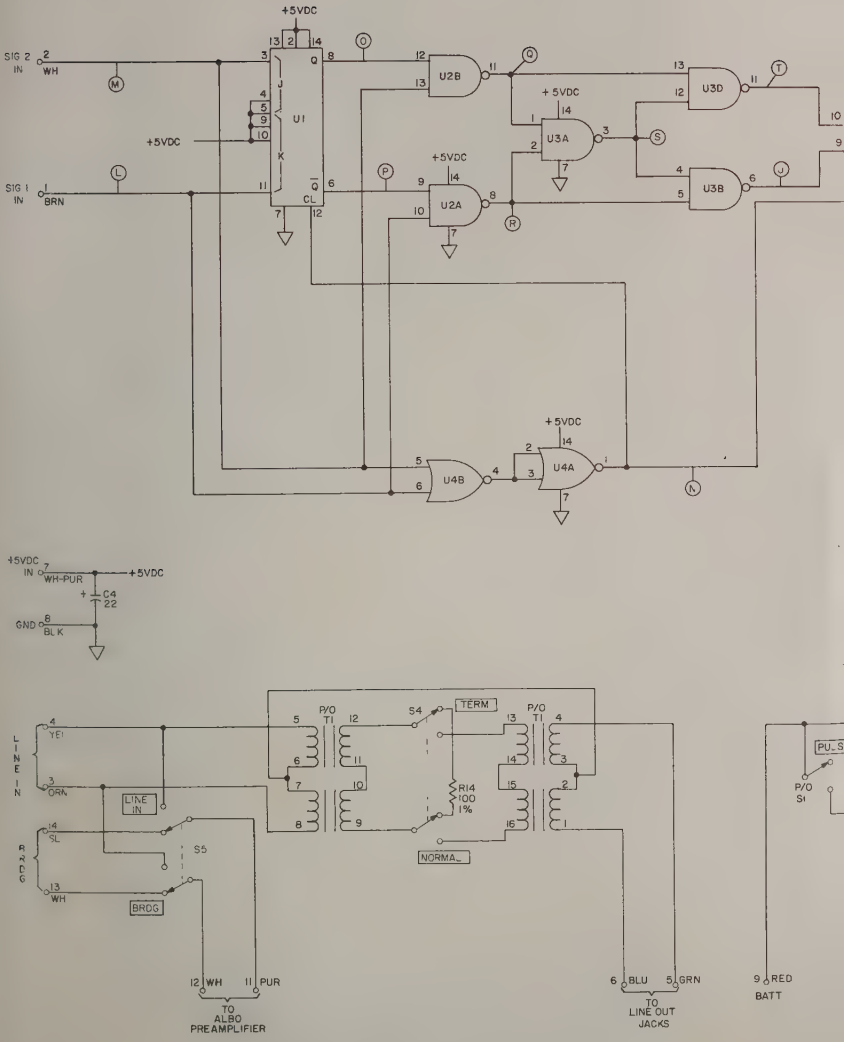
1. UNLESS OTHERWISE INDICATED:
   RESISTOR VALUES ARE IN OHMS
   CAPACITOR VALUES ARE IN MICROFAR
   INDUCTANCE VALUES ARE IN MILLIHE
   ALL DIODES ARE IN4148.

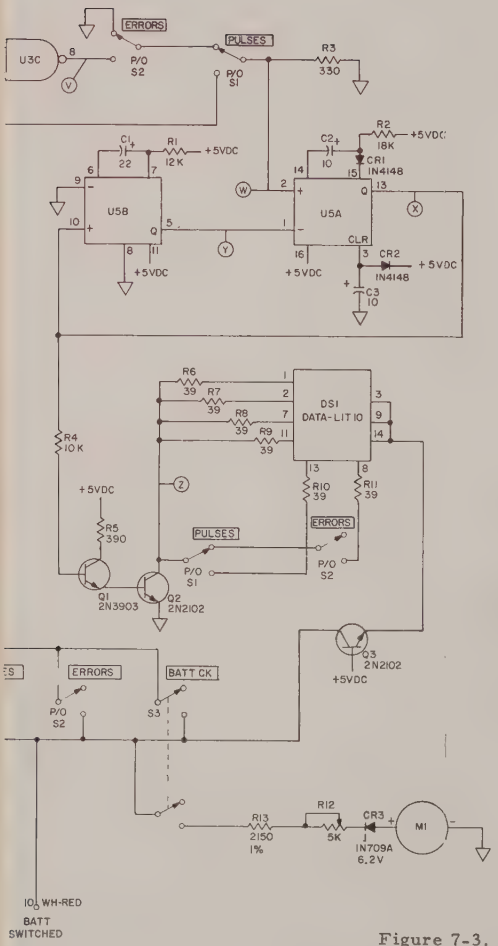


HIGHEST REFERENCE DESIGNATIONS		
L2	CR11	U4
R47	C26	Q14
REFERENCE DESIGNATIONS NOT USED		

I.C.	TYPE	GND	VCC
U1	CA3050	14	9
U2	CA3050	14	9
U3	LM741CN	4	7
U4	SN74123	8	16

Figure 7-2. ALBO Preamplifier Circuit Board PC1 Schematic Diagram


+5VDC
SIG 2 IN
2
WH
M
3
4
5
9
10
U1
J
K
Q
CL
+5VDC
L
SIG 1 IN
1
BRN
11
6
7
12
O
8
P
U2B
U2A
12
13
11
9
14
10
8
Q
R
+5VDC
U3A
U3D
U3B
U4B
U4A
S
T
J
N
+5VDC IN
7
WH-PUR
+5VDC
C4
22
GND
8
BLK
LINE IN
4
YEL
3
ORN
14
SL
13
WH
BRDG
S5
P/O T1
S4
TERM
R14
100
1%
NORMAL
P/O T1
P/O S1
PU_S
12 WH
11 PUR
TO ALBO PREAMPLIFIER
6 BLU
5 GRN
TO LINE OUT JACKS
9 RED
BATT



HIGHEST REFERENCE DESIGNATIONS		
R14	C4	CR3
S5	T1	U5
REFERENCE DESIGNATIONS NOT USED		

I C.	TYPE	GND	VCC
U1	SN7472	7	14
U2	SN7400	7	14
U3	SN7400	7	14
U4	SN7402	7	14
U5	SN74123	8	16

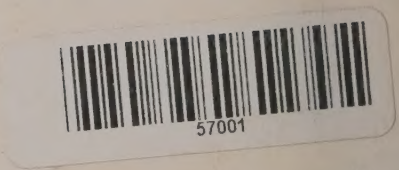
NOTES:
1. UNLESS OTHERWISE INDICATED:
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN MICROFARADS.
INDUCTANCE VALUES ARE IN MILLIHENRYS.

Figure 7-3. Error Detector Circuit Board PC2 Schematic Diagram

Model 7005 Errata Sheet
1–31–74

On ALBO Preamplifier Parts List change:
C5 to 22μF 10% 6V KEMET T330A226K006AS 310002260

In paragraph 3.8 step 8, change:
"If pulses are present on line, the letter E will flash in display window."
to read:
"If errors are present on line, the letter E will flash in display window."


57001